

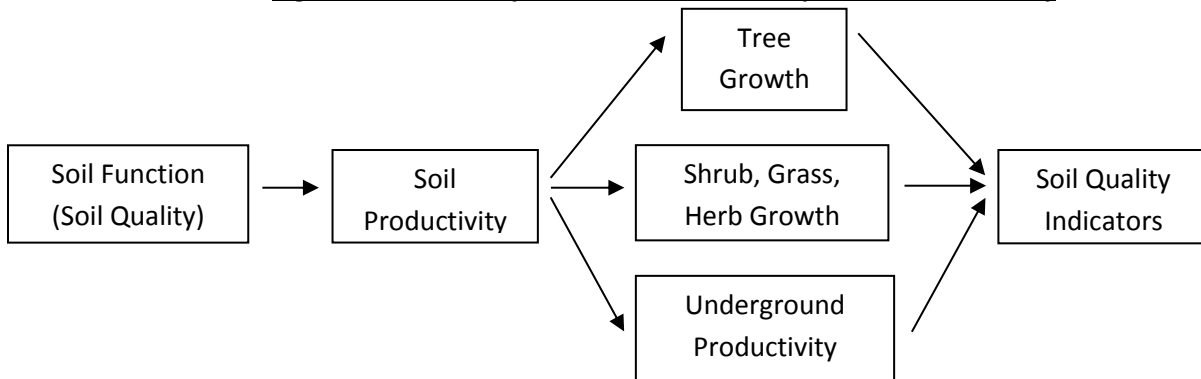
SOIL QUALITY AND PRODUCTIVITY

ID Team Recommended Plan Components

Desired Condition:

Long-term soil productivity and soil quality in the productive land base is not impaired (Figure 1, Table 1). Soil quality is the ability of the soil to maintain ecological function. Soil functions provide resources ecological processes and ecosystem services in perpetuity. Soil productivity is a summation of six soil ecological functions: soil biology, soil hydrology, nutrient cycling, carbon storage, stability and support, and filtering and buffering.

Figure 1. Soil Quality Indicators' Relationship to Soil Productivity



The Total Soil Resource Commitment (TSRC) is no more than 3-8% of watersheds at the 6HUC level. The soil stability and support function is maintained within the TSRC.

Table 1. Soil Ecological Functions with Attributes and Indicators of Long-term Soil Productivity

Soil Function	Selected Attributes	Soil Quality Indicator	Desired Future Condition
Biological	Roots and Aeration	Root growth	Root growth, both vertically and laterally, is unimpeded by compaction.
		Root Distribution	Root distribution and depth is expected for vegetation type and successional stage or desired plant community.
		Porosity	Macro and micro-pores are as expected for soil texture and type.
	Plant Community Potential and Thermodynamics	Plant Community Composition	The soil is capable of supporting a distribution of desirable plant species by vegetative layer (i.e. trees, shrubs, herbaceous) as identified in the potential plant community. The site has not transitioned to an undesirable state.
		Canopy Cover and Soil Cover	Soil temperature and moisture regimes are maintained in conditions to support desired plant communities.
Hydrologic	Infiltration	Surface Structure	Surface structure is as expected for the site

			(e.g. granular, subangular blocky, single grain).	
		Surface Pore Space	There are common to many tubular pores with high vertical continuity.	
		Surface Crusting	Surface crusting is as expected for the site.	
	Water Absorption and Storage	Available Water	Site water is as expected for the soil type or has been improved.	
	Water Transmission	Subsurface Flow Connectivity *	Maintain subsurface flow connectivity with the streams (i.e. subsurface flow is not obstructed or intercepted).	
Nutrient Cycling	Organic Matter Composition	Forest or Rangeland Floor	Forest and rangeland floor is distributed and the composition is appropriate for vegetation type and successional stage. Rangeland to be determined by Ecological Site Descriptions (ESD) specific to soil type.	
			Forest Habitat Type	Depth
			Warm/Dry Moderately Warm/Dry Moist Mixed Conifer Cool, Wet/Moist Subalpine Fir Cool/Cold Dry Upper Subalpine	To be developed working with Rocky Mountain Research Station (RMRS - Terrie Jain and Deb Dumroese) on March 5th
		Fine Woody Material (less than 3 inches)	Fine woody material is on site in various stages of decay in amounts appropriate for habitat type.	
		Coarse Woody Material (Greater than 3 inches)	Coarse woody material is on site in various stages of decay and size classes in amounts appropriate for habitat type.	
			Forest Habitat Type	Tons/Ac
			Warm/Dry Moderately Warm/Dry Moist Mixed Conifer Cool, Wet/Moist Subalpine Fir Cool/Cold Dry Upper Subalpine	3 - 8 4 - 9 10 - 20 4 - 11 4 - 15
	Nutrient Availability	Surface (A) horizon or mollic layer	"A" horizon is present, well distributed, not fragmented. The depth of the A horizon is within expected range.	
		Nutrient Deficiency	Soil nutrients are maintained at levels to support desired vegetation.	

		Ash Cap	Soil ash cap is intact and as expected for the site.
Carbon Storage	Carbon Storage	Carbon Storage*	The ability of the soil to store carbon has not been impaired.
Support and Stability	Stability	Surface erosion (wind, rill, or sheet)	Erosion is occurring at natural levels or not evident. Bare ground is within expected ranges for soil and habitat type.
		Site stability (mass erosion, landslide prone)	Site stability potential is unchanged or stability has been improved.
	Deposition	Soil deposition	Deposition is at natural levels and recent depositional material is vegetated.
Filtering and Buffering	Filtering	Soil contamination	Soil is free of chemical or industrial contamination.

* Indicators not linked to Soil Productivity.

Objectives:

1. Within the first decade, restore impaired soil functions on at least 2500 acres.

Standards:

Timber, Silviculture, and Fuels Management:

1. Within three years of completion of project activities, at least 85% of land within activity area boundaries has all six soil ecological functions in a functioning condition; or if previous activities resulted in impaired soil function, current project activities result in a trend toward improved soil functions.

Grazing

2. Allotments with transitory range will be managed to maintain 85% of the capable range with all six soil ecological functions in a functioning condition or trending towards improved soil functions.

Guidelines:

Timber, Silviculture, and Fuels Management:

1. Forest Floor Depth - To be developed working with Rocky Mountain Research Station (RMRS - Terrie Jain and Deb Dumroese) on March 5th
2. Fine Woody Material - To be developed working with RMRS (Terrie Jain and Deb Dumroese) on March 5th
3. The following levels (tons/ac) of downed coarse woody debris (> 3 inches) should be maintained on site after management to ensure sufficient organic materials to maintain nutrient cycling and soil biology:

Habitat type	Regeneration Harvest	Intermediate Harvest and Fuels Reduction
Warm/Dry	5-13	3-8
Moderately Warm/Dry	7-14	4-9
Moist Mixed Conifer	17-33	10-20
Cool, Wet/Moist Subalpine Fir	7-18	4-11
Cool/Cold Dry Upper Subalpine	7-24	4-15

4. To maintain long-term soil productivity, activities to restore soil functions on temporary roads should be accomplished within three years of completion of harvest activities.
5. To maintain soil support and stability, ground-based harvest equipment should be limited to slopes less than 40%.

Glossary:

Activity Area - A land area affected by a management activity such as a harvest unit including landings and temporary roads outside the harvest unit boundary but excluding system roads. An activity area may also be a prescribed burn unit or any area delineated on the ground for a specific treatment. Activity areas must be feasible to monitor.

Function Affected but Not Impaired –When any or a combination of soil quality indicators is altered but can still provide all soil ecological functions.

Functioning Condition – Soil quality indicators are at the Desired Future Condition or Affected but Not Impaired.

Impaired Function – When any or a combination of soil quality indicators is altered to a point where a soil can no longer provide an ecological function then its quality or productivity is impaired. Active restoration may be required to restore soil function.

Productive Land Base - Lands where vegetation and water resource management are the principal objectives.

Soil Productivity - The inherent capacity of the soil resource to support appropriate site-specific biological resource management objectives, which includes the growth of specified plants, plant communities, or a sequence of plant communities to support multiple land uses.

Soil Quality - The capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation and ecosystem health.

Soil Quality Indicator - A quantitative or qualitative measure used to estimate soil functional capacity. Indicators should be adequately sensitive to change, accurately reflect the processes or biophysical mechanisms relevant to the function of interest, and be cost effective and relatively easy and practical to measure.

Total Soil Resource Commitment – The conversion of a productive site to an essentially non-productive site (0 to 40 percent of natural productivity) for a period of more than 50 years. Examples include system roads, administrative sites, developed campgrounds, rock quarries, mine sites, livestock watering facilities, and home ignition zones.